Antisocial and borderline personality disorders in the offspring of antenatally depressed mothers – a follow-up until mid-adulthood in the Northern Finland 1966 birth cohort

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ABSTRACT

Background: Maternal depression is common during pregnancy, affecting 10–15% of mothers. In previous reports, the offspring of antenatally depressed mothers have had an elevated risk for antisocial, criminal and violent behaviour in adolescence, and for borderline personality features in childhood, but long-term outcomes are unknown.**Aims:** To study whether the adult offspring of antenatally depressed mothers have an elevated risk for antisocial (ASPD) or borderline personality disorder (BPD) when followed until mid-adulthood.**Methods:** In the general population-based Northern Finland 1966 Birth Cohort, mothers of 12,058 children were asked during mid-gestation if they felt depressed. Of the mothers, 14% reported being depressed. The offspring were followed for 49 years. The diagnoses of in- and outpatient-treated ASPD and BPD in the offspring were detected using the Finnish Care Register for Healthcare. Maternal antenatal smoking, newborn´s low birthweight or short gestational age, father's social class, and family type at birth were considered as confounding variables. Logistic regression analyses on the potential confounders were performed. Maternal postnatal depression and paternal ASPD information was not available.**Results:** In the male offspring of antenatally depressed mothers, the risk for ASPD was elevated (adjusted odds ratio 5.6; 95% confidence interval 1.8–17.8), but not in female offspring. The risk for BPD was not elevated in the offspring of antenatally depressed mothers in this study.**Conclusions:** The sons of antenatally depressed mothers had an increased risk for ASPD. Prevention and treatment of antenatal depression might present an opportunity to decrease the risk of antisocial personality in the offspring.

Keywords: Antenatal depression ; antisocial personality disorder ; borderline personality disorder ; maternal depression during pregnancy ; Northern Finland 1966 birth cohort

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Introduction

Maternal depression during pregnancy is common, affecting about 10–15% of mothers [1–3]. Antenatal depression is clearly one of the most prevalent pregnancy complications, but often misdiagnosed and untreated [4,5]. It is a major risk factor for postnatal depression [6–8] and has been associated with adverse outcomes in offspring. Maternal antenatal depression may affect foetal neurodevelopment, resulting in psychopathology, especially in those offspring

with genetic predisposition for mental disorders [9–13]. Depression may also interrupt the early mother-baby attachment, both during pregnancy and postnatally, which may later impair the interaction between the mother and the child [14,15]. An elevated risk for internalising and externalising symptoms [16] and traits of borderline personality disorder in childhood [17], as well as depression and anxiety in adolescence [18,19] are reported in the children of antenatally depressed mothers. Further, the adolescent sons of antenatally depressed mothers are found to have an increased risk for antisocial and violent behaviour [20], while the adolescent daughters are at elevated risk for depression [21].

To the authors' knowledge, the only studies with psychiatric follow-up of the offspring of antenatally depressed mothers until middle adulthood are from the general population-based Northern Finland 1966 Birth Cohort (NFBC 1966) [11,12,22–25]. The adult male offspring of antenatally depressed mothers were found to have an increased risk for criminal behaviour, especially violent recidivism in the 33-year follow-up of the NFBC 1966, using the nationwide register of the Ministry of Justice on criminal offences [11]. In the preliminary findings of the NFBC 1966 with a 28-year follow-up, the offspring of antenatally depressed mothers had an elevated risk for severe personality disorders [26].

The cluster B, i.e. dramatic and emotional unstable personality disorders, including antisocial personality disorder (ASPD) and borderline personality disorder (BPD), are found to be the most common hospital-treated personality disorders [27], although they are quite rare in the general population [28,29]. The prevalence of ASPD is 2–3% in the general population [29], but in prison studies, the prevalence of ASPD is up to 47% in men and 21% in women [30]. ASPD is thought to be perhaps the most severe personality disorder, because of the criminal behaviour and violence, and poor adherence to treatment [31]. The prevalence of BPD is 1–6% in the general population [29,32]. It is the most common personality disorder in clinical samples, with a prevalence of 10% of all psychiatric outpatients and 15–25% of inpatients [32]. Both these disorders have high psychiatric comorbidity [28,33], functional impairment and mortality, due to substance abuse and suicidality [30,32]. ASPD and BPD may have their origins in gene-environment interactions, as well as in childhood psychosocial factors [34–38].

Although there are findings of elevated risk for antisocial behaviour in adolescence and traits of BPD in childhood in the offspring of antenatally depressed mothers, long follow-up studies are lacking. The aim of this study was to examine whether the adult male and female offspring of antenatally depressed mothers have an elevated risk for ASPD or BPD. We hypothesized, that maternal antenatal depression is associated with increased risks for hospital-treated antisocial and borderline personality disorder in the offspring, and the risk is more elevated in offspring with both maternal antenatal depressed mood and parental severe mental disorder.

Materials and methods

Subjects of the Northern Finland 1966 birth cohort (NFBC 1966)

The study is based on the unselected, general population-based Northern Finland 1966 Birth Cohort (NFBC 1966). The cohort covers 96.3% (N = 12,058) of all live births in the two northernmost provinces of Oulu and Lapland in Finland during the year 1966 [39]. Permission to gather data was obtained from the Ministry of Social and Health Affairs and the study has been approved by the Ethics Committee of the Northern Ostrobothnia Hospital District. All subjects alive and living in Finland at age 16 (N = 11,029) were included in the study. The cohort members have been followed for 49 years.

Maternal antenatal depressed mood

The cohort members´ mothers were asked by the interviewing nurse at the antenatal clinic during mid-gestation (mainly between the 24th and 28th gestational weeks) to determine their mood in a three-variable scale (normal, depressed or very depressed mood). One-item questionnaires have been shown to be valid in screening major depression in the general population [40]. Altogether 14.4% (N = 1704) of the mothers (N = 11,804) felt depressed, and of those 12.1% (N = 1432) had a depressed mood and 2.3% (N = 272) a very depressed mood [11]. The two latter categories were combined and considered 'depressed.'

Parental severe mental disorder

Parental hospital inpatient-treated (later referred as 'severe') mental disorders were taken into account to study whether parental severe mental disorders are associated with the risk for ASPD and BPD in the offspring, and wheth-

er the offspring with both maternal antenatal depressed mood and parental severe mental disorder would be at higher risk for ASPD or BPD than offspring with only maternal antenatal depressed mood. The Finnish Care Register for Health Care (CRHC) was used to identify all parental hospital inpatient-treated non-organic mental disorders (ICD-8 codes 295-309) between the years 1972 and 1984, i.e. during offspring childhood.

Outcome variables: Antisocial and borderline personality disorder in the offspring (birth cohort members)

Data on offspring personality disorders were detected using the CRHC. The CRHC includes data on inpatients treated at clinics in psychiatric and general hospitals, wards of local health centres, military wards, prison hospitals and private hospitals nationwide starting from the year 1972, and outpatient data from specialised care starting from the year 1998.

The cohort members appearing in the CRHC for ASPD (ICD-8 301.70/ICD-9 3017/ICD-10 F60.2) or BPD (ICD-8 301.30/ICD-9 3018 D/ICD-10 F60.3) treated as inpatients between 1982–2015, or as specialised health care outpatients between the years 1998 and 2015, were detected.

Confounding variables

The confounding variables were selected based on previous findings. The potentially confounding variables were categorized as perinatal biological risk factors and early psychosocial risk factors.

Perinatal biological risk factors

Maternal smoking during pregnancy (categories: 1. none or cessation before pregnancy, 2. smoked more than one cigarette daily during the entire duration of pregnancy) was considered as a confounding variable for its association with both maternal antenatal depression [41] and antisocial behaviour in the offspring [42]. *Low birthweight (LBW) or short gestational age* (1. normal pregnancy, 2. LBW [<2500 g] or short gestational age [<37 weeks]) were taken into account as confounding factors because babies of antenatally depressed mothers have a greater risk for LBW and preterm birth, which may affect the neurodevelopment and associate with increased risk for mental disorders in the offspring [43].

Early psychosocial risk factors

Familial factors, such as parental occupation and marital status, are associated with maternal antenatal depression [41]. Further, low family socioeconomic status, growing up in a single-parent family and the absence of biological fathers are associated with antisocial behaviour and personality disorder traits in the offspring [37,44], thus the *father´s socioeconomic status in 1966 (SES)* (1. other [educated professionals, skilled workers and farmers] 2. low [unskilled workers]), and *family type in 1966* (1. full: mother and father, 2. single parent family) [38,45] were included as confounding variables in the study.

All the included confounding variables were statistically significantly associated with maternal antenatal depressed mood ($p < .001$) (Table 1). Mother´s smoking during pregnancy was found to be significantly associated with ASPD in male offspring (crude OR 4.7; 95% CI 1.5–15.0, $p = .008$), but not for BPD in males, or ASPD and BPD in the female offspring. None of the other confounders were associated with ASPD or BPD in the offspring.

Table 1. Background variables according to mother's mood during pregnancy in the Northern Finland 1966 Birth Cohort.[AQ3]

	Maternal antenatal depressed mood						
	Total ($N = 11,029$)		No ($N = 9468$)		Yes ($N = 1561$)		
	N	%	*N*	%	*N*	%	*p*-value[a]
Gender							
Male	5661	51.3	4869	51.4	792	50.7	.611
Female	5367	48.7	4598	48.6	769	49.3	

	Maternal antenatal depressed mood						
	Total (N = 11,029)		No (N = 9468)		Yes (N = 1561)		
	N	%	N	%	N	%	p-value[a]
Mother´s smoking during pregnancy							
No	9285	85.2	8065	86.1	1 220	79.6	<.001
Yes	1613	14.8	1301	13.9	312	20.4	
LBW or short gestational age							
No	10,129	91.8	8736	92.3	1 393	89.2	<.001
Yes	900	8.2	732	7.7	168	10.8	
Father´s SES in 1966							
Other	8340	78.8	7359	79.9	981	71.2	<.001
Low	2249	21.2	1852	20.1	397	28.8	
Family type in 1966							
Two-parent family	10,600	96.2	9230	97.6	1 370	87.8	<.001
One-parent family	416	3.8	226	2.4	190	12.2	
Parental severe mental disorder							
No	9843	90.0	8541	90.9	1 302	84.6	<.001
Yes	1090	10.0	853	9.1	237	15.4	

LBW: Low birth weight (<2500 g).

Short gestational age (<37 weeks).

SES: Socioeconomic status.

p-values calculated from the Chi-squared test.

Statistical analysis

The occurrences of ASPD and BPD in the male and female offspring (birth cohort members) during the 49-year follow-up were calculated. The outcome variables in the male and female offspring were studied separately because the distribution of personality disorders is found to differ between men and women [27]. Cross-tabulations were conducted to assess the relationship between maternal antenatal depressed mood, parental severe mental disorders, and ASPD and BPD in the offspring.

The significance of differences was tested using the Pearson Chi-Square test. Crude and adjusted odds ratios (OR) with 95% confidence intervals (95% CI) were calculated from logistic regression analyses. The logistic regression analyses were conducted stepwise in different models, to separately assess the confounding effect of prenatal biological factors and socioeconomical factors at birth. In the first model, the crude OR were calculated without adjustments. In the second model, the logistic regression analysis was conducted with adjustments for the prenatal biological risk factors (maternal prenatal smoking and LBW or prematurity). In the third model, logistic regression analysis was conducted both with the prenatal biological risk factors and the psychosocial risk factors (father´s SES and family type in 1966). IBM SPSS Statistics version 24 was used.

Results

This study sample of the NFBC 1966 consists of 11 029 cohort members (offspring) who were living in Finland at 16 years of age, for whom information on maternal prenatal mood was available, and who had not denied the study the use their data. Of those, 14% (N = 1561) had mothers with depressed mood during pregnancy and 10% had one parent with a severe mental disorder during 1972–1984. During the 49-year follow-up, 0.2% (N = 22; 82% males) of the cohort members had been diagnosed with ASPD, and of those, 21 (95.5%) were treated as hospital inpatients and one (4.5%) as a specialised health care outpatient. One patient was treated in specialised care as both an inpatient and outpatient. The mean age of first ASPD diagnosis was 26.8 years (range 16–42 years of age). Of the cohort members, 0.8% (N = 86; 38% males) were diagnosed with BPD, of whom 67 (77.9%) had been treated as hospital inpatients, 36

(41.9%) as specialised health care outpatients, and 17 (20.0%) as both inpatients and outpatients. The mean age of first BPD-diagnosis was 32.4 years (range 16–48 years of age).

ASPD and BPD in the offspring of antenatally depressed mothers

The occurrence of ASPD was 1.0% ($N = 8$) in the male offspring of antenatally depressed mothers ($N = 792$), and 0.2% ($N = 10$) in the male offspring without maternal antenatal depressed mood ($N = 4869$). The risk of ASPD (crude OR 5.0; 95% CI 2.0–12.6) was elevated in the male offspring of antenatally depressed mothers (Table 2). After logistic regression analyses with adjustments for perinatal biological risk factors and psychosocial risk factors, the results remained statistically significant. Of the female offspring, 0.07% ($N = 4$) had been diagnosed with ASPD, of whom one was born to an antenatally depressed mother. The statistical power was too low to make reliable estimates of the risk of ASPD in daughters of antenatally depressed mothers, compared to female offspring without maternal antenatal depressed mood (Table 2).

Table 2. Antisocial personality disorder (ASPD) in the male and female offspring with and without maternal antenatal depressed mood during the 49-year follow-up of the Northern Finland 1966 Birth Cohort.

	ASPD	Model 1	Model 2	Model 3
	% (*N*)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Male offspring (cohort members) ($N = 5\,661$)	0.3 (18)			
Maternal antenatal depressed mood				
No ($N = 4\,869$)	0.2 (10)	1.0	1.0	1.0
Yes ($N = 792$)	1.0 (8)	5.0 (2.0–12.6)***	4.8 (1.8–12.5)**	5.6 (1.8–17.8)**
Female offspring (cohort members) ($N = 5\,367$)	0.07 (4)			
Maternal antenatal depressed mood				
No ($N = 4\,598$)	0.07 (3)	1.0	1.0	1.0
Yes ($N = 769$)	0.13 (1)	2.0 (0.2–19.2)	1.6 (0.2–16.0)	NA
All cohort members ($N = 11\,029$)	0.2 (22)			
Maternal antenatal depressed mood				
No ($N = 9\,468$)	0.1 (13)	1.0	1.0	1.0
Yes ($N = 1\,561$)	0.6 (9)	4.2 (1.8–9.9)***	3.8 (1.6–9.2)**	4.0 (1.4–11.7)*

ASPD: Specialised care in- and outpatient-treated patients with clinically diagnosed antisocial personality disorder.

Model 1: Crude OR without adjustments.

Model 2: Adjusted for maternal smoking during pregnancy, and LBW or short gestational age.

Model 3: Adjusted for maternal smoking during pregnancy, LBW or short gestational age, father´s social class at 1966, and marital status at 1966.

*$p < .05$; ** $p < .01$; *** $p = .001$.

The occurrence of BPD in the male offspring of antenatally depressed mothers was 0.6% ($N = 5$), and 0.6% ($N = 28$) in the male offspring without maternal antenatal depressed mood. Thus, the risk for BPD was not elevated in the sons of antenatally depressed mothers (crude OR 1.1; 95% CI 0.4–2.9) (Table 3). The occurrence of BPD in the female offspring was 1.0% ($N = 53$), of whom 11 (21%) were born to antenatally depressed mothers. The risk of BPD was not elevated in the daughters of antenatally depressed mothers (Table 3).

Table 3. Borderline personality disorder (BPD) in the male and female offspring with and without maternal antenatal depressed mood during the 49-year follow-up of the Northern Finland 1966 Birth Cohort.

	BPD	Model 1	Model 2	Model 3
	% (*N*)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Male offspring (cohort members) (*N* = 5 661)	0.6 (33)			
Maternal antenatal depressed mood				
No (*N* = 4 869)	0.6 (28)	1.0	1.0	1.0
Yes (*N* = 792)	0.6 (5)	1.1 (0.4–2.9)	1.1 (0.4–2.8)	0.8 (0.2–2.6)
Female offspring (cohort members) (*N* = 5 367)	1.0 (53)			
Maternal antenatal depressed mood				
No (*N* = 4 598)	0.9 (42)	1.0	1.0	1.0
Yes (*N* = 769)	1.4 (11)	1.6 (0.8–3.1)	1.5 (0.8–3.0)	1.5 (0.7–3.1)
All cohort members (11 029)	0.8 (86)			
Maternal antenatal depressed mood				
No (*N* = 9 468)	0.7 (70)	1.0	1.0	1.0
Yes (*N* = 1 561)	1.0 (16)	1.4 (0.8–2.4)	1.3 (0.8–2.3)	1.2 (0.6–2.3)

BPD: Specialised care in- and outpatient-treated patients with clinically diagnosed borderline personality disorder.

Model 1: Crude OR without adjustments.

Model 2: Adjusted for maternal smoking during pregnancy, and LBW or short gestational age.

Model 3: Adjusted for maternal smoking during pregnancy, LBW or short gestational age, father's social class at 1966, and marital status at 1966.

ASPD and BPD in the offspring with parental severe mental disorder

Of the NFBC 1966 male cohort members with parental severe mental disorder (*N* = 545, 9.7%), 0.7% (*N* = 4) had been diagnosed with ASPD during the 49-year follow-up, compared to 0.02% (*N* = 13) ASPD-diagnosed male cohort members without parental severe mental disorder. The risk for ASPD was not statistically significantly elevated in the male offspring with parental severe mental disorder (p = .054). None of the female offspring with parental severe mental disorder (*N* = 545, 10.2%) were diagnosed with ASPD during the follow-up.

Of the male cohort members with parental severe mental disorder 1.3% (*N* = 8) had been diagnosed with BPD, and 0.5% (*N* = 25) without parental severe mental disorder. The risk for BPD was elevated in the male offspring with parental severe mental disorder (p = .02).

Of the female offspring with parental severe mental disorder, 1.7% (*N* = 9) were diagnosed with BPD, compared to 0.9% (*N* = 44) female offspring without parental severe mental disorder diagnosed with BPD. The risk for BPD was not elevated in the female offspring with parental severe mental disorder (p = .10).

ASPD and BPD in the offspring with both antenatally depressed mothers and parental severe mental disorder

The male offspring with both antenatally depressed mothers and parental severe mental disorder had an elevated risk for ASPD (p < .001, *N* = 2, 1.8%) and for BPD (p = .015, *N* = 3, 2.6%), compared to the male offspring without maternal antenatal depressed mood and parental severe mental disorder. The number of subjects in these risk groups was very low, which weakens the significance of these findings. Of the female offspring with both antenatally depressed mothers and a parent with severe mental disorder, none had been diagnosed with ASPD and 4 (3.3%) had been diagnosed with BPD, but the risk for BPD was not elevated (p = .07).

Discussion

In the present study, the male offspring of antenatally depressed mothers had an increased risk for ASPD, but not for BPD during the 49-year follow-up. Parental severe mental disorder did not explain this association but was associated with elevated risk for BPD in the male offspring. The female offspring of antenatally depressed mothers did

not have an elevated risk for ASPD or BPD, although the number of female subjects with ASPD diagnosis was too low to make statistically reliable estimates. However, because of the observational nature of the study, cause-effect relationships cannot be conclusively stated. To the author´s knowledge, this is the first long follow-up study on severe ASPD and BPD in the adult offspring of antenatally depressed mothers, where parental severe mental disorders were taken into account.

In previous studies, maternal antenatal depression has been associated with perinatal complications, maladjustment and difficult temperament of the newborn, developmental delays, internalising and externalising symptoms, and conduct problems in pre-adolescent children, as well as externalising symptoms and depression in adolescent and young adult offspring [13,46–50]. Findings of elevated risk for severe mental disorders in the adult offspring of antenatally depressed mothers who also suffered from parental psychosis/severe mental disorder are reported in our previous studies based on the NFBC 1966 [11,22,51].

The origins of cluster B personality disorders probably lie in gene-environment interactions and early psychosocial environment. The development of a personality disorder is thought to start in childhood, and childhood conduct disorders are found to predict adulthood personality disorders [44,52], especially ASPD [53]. Being born to a single-parent family has been previously shown to predict cluster B personality disorders in the adult offspring in the sub-study of the NFBC 1966 [38]. Early separation has been associated with antisocial and violent criminal behaviour in young men [54]. Parental mental disorders are found to increase the risk for offspring personality disorders [10,36], although not in the sub-study of the NFBC 1966 [38]. The adolescent sons of antenatally depressed mothers had an elevated risk for antisocial and violent behaviour in a British community sample [20], as also in adulthood for criminal behaviour, especially violent recidivism in the NFBC 1966 [11]. In the present study, the prevalence of ASPD was found to be elevated in the adult sons of antenatally depressed mothers, and the prevalence of BPD was elevated in offspring whose parent had been affected with a severe mental disorder.

Maternal antenatal depressed mood could be associated with an elevated risk for ASPD through various pathways. Maternal antenatal depression exposes the foetus to neurobiological changes [46]. Severe personality disorder may result from disturbance in function of the hypothalamic-pituitary-adrenal (HPA)-axis. Cortisol levels among patients with antisocial behaviour seem to be lower than usual [55]. Mothers' prenatal depression is associated with overactivity of the HPA-axis and downregulation of the placental 11β-hydroxysteroid-enzyme, resulting in increased transplacental transfer of cortisol to the foetus [56]. The chronically elevated foetal cortisol levels may lead to later impaired function of the HPA-axis [57], potentially affecting the later vulnerability to psychopathology [58].

Maternal antenatal depressed mood may interrupt the early interaction between the mother and the child. Maternal depression affects the processing of the infant's emotion and it may proceed to a disrupted early mother-infant relationship, possibly disturbing offspring stress control [59]. Depressive symptoms in early pregnancy complicate the interpretation of infant emotions and signals modifying the relationship between the mother and the child. This may lead to attachment difficulties that predispose the child to psychiatric disorders in adulthood [60]. Maternal antenatal depression is also associated with decreased maternal sensitivity [61] and increased risk of maltreatment of the child, especially among young mothers [62]. Recent findings suggest that the effect of maternal prenatal depression on the risk of offspring internalising and externalising problems, depression and antisocial behaviour may be mediated by maltreatment of the child [16,63,64]. Childhood maltreatment is also associated with increased risk for cluster B personality disorders [44]. Antenatal depression increases the risk of postnatal depression and later periods of depression [8]. Postpartum depression is associated with behavioural problems of the child [13,47], which is a risk for later antisocial and other personality disorders [52]. Still, maternal antenatal depressed mood has been associated with offspring childhood psychopathology even when controlling for postnatal depression and parenting index [49].

Some shared general underlying factors, such as genetics, marital problems, and intimate violence, may associate both with maternal antenatal depressed mood and offspring ASPD, and thus potentially mediate some of the associations between these conditions. In this study, paternal SES and family type did not affect the association between maternal antenatal depressed mood and their sons´ ASPD. A mother´s or father´s hospital-treated mental disorder during the offspring's childhood (during 6–18 years of age) did not explain the association between maternal antenatal depressed mood and increased risk for ASPD in the male offspring, either. Paternal ASPD could have both genetic and environmental influences on the risk for ASPD in the offspring. In the NFBC 1966, paternal ASPD was not screened. We did not include paternal hospital-treated ASPD as a confounding variable, because ASPD is rarely hos-

pital-treated. Thus, hospital-treated ASPD cannot be accounted as a marker of genetic risk for ASPD, since most of the fathers with ASPD (without hospital treatment) would remain undetected.

ASPD is a severe health problem causing disability, unemployment, suicides and criminality [30]. Because ASPD is treatment-resistant [31], efforts should be directed toward the prevention of ASPD. If maternal antenatal depressed mood is associated with increased risk for ASPD and criminality in the offspring [11], it could be speculated that prevention or effective treatment of antenatal depression may decrease the risk of ASPD in the offspring.

We hypothesised, that the offspring of antenatally depressed mothers would also be at increased risk of BPD, but our findings did not support this hypothesis. In previous studies, the three-year-old children of antenatally depressed mothers have had an elevated risk for negative emotionality [65], and for traits of BPD at age 11–12 years [17], which both could be associated with BPD in adulthood [65]. However, we did not find associations between maternal antenatal depressed mood and offspring BPD in adulthood. The aetiology of BPD is multifactorial and varies between subjects, and only a few factors, such as maltreatment and other childhood traumas [66,67], are found to individually increase the risk for BPD in the general population. In this study, the risk of BPD was elevated in the male offspring whose parent was diagnosed with a severe mental disorder. It is likely that maternal antenatal depressed mood itself does not increase the risk for adulthood BPD, but it may be one factor among other adversities which are involved with the aetiology of the disorder. More studies are needed to further evaluate the associations between maternal antenatal depression and the risk of BPD in offspring.

Perinatal mental health has recently seen a rise in interest in research and clinical practice. Still, screening, diagnostics and treatment of perinatal depression are not efficient enough [4]. Mothers should be asked about their depressive symptoms during pregnancy and postnatally, and families with severe mental disorders should be treated with special concern, considering also child-focused interventions [68]. Health care providers should have intervention programmes for the treatment of perinatal depression. As interventions for pregnant women with major depressive disorder, Cognitive Behavioural Psychotherapy and Interpersonal Psychotherapy may be beneficial [69], and pharmacological treatment can be considered for women with moderate to severe antenatal depression, along with non-pharmacological treatments [70]. The World Health Organization has published a manual for the psychosocial management of perinatal depression [71] for all primary care workers worldwide.

Strengths and limitations

This is the first general population study where maternal antenatal depression is studied as a risk factor for antisocial and borderline personality disorders in adult offspring. A strength of this study was its ability to utilise a prospective general population-based birth cohort, the NFBC 1966, with a long follow-up time, starting antenatally. The study sample was representative, covering 91% of the NFBC 1966 and 88% of all children born in the year 1966 in Northern Finland. In the statistical analyses, adjustments were gradually performed for many potential confounding factors. Diagnoses of ASPD and BPD in the offspring and of severe mental disorders in their parents were received from the nationwide CRHC with relatively reliable diagnoses [72–74].

There are several limitations in the study. Maternal antenatal depression was not clinically diagnosed or screened by a validated screening method but was the mothers' self-reported depressed mood. However, the prevalence of antenatally depressed mood – about 14% – was in the same range as in other studies [1,2], e.g. in the Avon longitudinal study of parents and children (ALSPAC), measured by the Edinburgh Postnatal Depression Scale (EPDS) [1,75]. Although questionnaires containing many questions, such as the EPDS, are widely used, one-item questionnaires have been shown to be valid in screening major depression, at least in the general population [40].

Depressed mood is the main symptom of depression, but it may also be a symptom of another mental disorder, such as bipolar disorder, schizophrenia or post-traumatic stress disorder, which were not identified in the mothers during pregnancy in the present study. Further, we were not able to include postnatal depression as a confounding factor due to the lack of mother's psychiatric postnatal information and to the original nature of the NFBC 1966, which was to study prenatal risk factors for LBW [12]. Paternal ASPD was not screened either. The CRHC-data was available starting from year 1972, thus we did have data on parental mental disorders in the offspring during childhood and adolescence (6–18 years of age). We did not have data on the mother´s mental health prior to pregnancy, alcohol use during pregnancy, or maternal or offspring exposure to violence.

In the NFBC 1966, with over 12,000 live-born babies, the cumulative incidence of ASPD (0.2%) and BPD (0.8%) was rather low compared to previous studies [29,30,32]. Subjects with ASPD tend not to seek healthcare very often, which makes it difficult to conduct reliable register-based analyses on ASPD [76]. Also, personality disorders are highly comorbid with axis I psychiatric disorders [28,33]. The clinical process for diagnosing personality disorders with axis I disorders varies and personality disorders tend to be under-diagnosed [77]. The low number of ASPD in the NFBC 1966 cohort members may have biased the statistical analyses in the present study. Because of the low number of ASPD cases ($N = 4$) in female offspring, it was not possible to conduct statistical tests related to ASPD in daughters of antenatally depressed vs. non-depressed mothers. Large general population-based cohort studies where the subjects are interviewed for the symptoms of personality disorders are needed to further investigate the effect of maternal antenatal depression on the risk of personality disorders in the offspring.

Conclusion

This study adds to knowledge about ASPD and BPD in the adult offspring of antenatally depressed mothers. We found an elevated prevalence of ASPD in the male offspring of antenatally depressed mothers during the long follow-up until 49 years of age. The mechanisms behind this relationship may be various, both genetic and environmental. ASPD is usually persistent, and the patients tend not to commit to treatment, which is why the prevention of ASPD is crucial. Maternal mood should be evaluated both during pregnancy and after delivery in primary care, and organised intervention programmes for the whole family should be available both in primary and specialised care. Intervention studies are needed to investigate whether the efficient recognition and treatment of antenatal depression reduces adverse long-term outcomes in the offspring.

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Disclosure statement

The authors have no competing interests to disclose.

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